In this thesis, a portfolio optimization with integer variables which influence optimal assets allocation, is studied. At the beginning basic terms, measures of risk - variance, Value at Risk (VaR), Conditional Value at Risk (CVaR) are defined and the mean-risk models are derived for a practical application. Heuristics and standard algorithms of software GAMS are used for solving problems of the combinatorial portfolio optimization. Two types of the heuristics are described: the Threshold Acceptance and the Genetic Algorithm. The heuristics are implemented in the MATLAB, applied on financial data and compared with an output of the software GAMS.